TOWN OF NIAGARA-ON-THE-LAKE

2023 STRUCTURE ASSET MANAGEMENT COST FORECAST

March 2024

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March 19, 2024

Town of Niagara-on-the-Lake
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Attention: **Mike Komljenovic, Engineering Supervisor**

Reference: **2023 Structure Asset Management Cost Forecast**
ELLIS Job No.: 1140

We are pleased to submit the 2023 Structure Asset Management Cost Forecast (SAMCF) for the Town of Niagara-on-the-Lake's bridge and culvert structures, which expands on information gathered from the 2023 Municipal Bridge Appraisal. The following report contains information relating to the Town's 57 bridge, culvert, and pedestrian structures with spans over 3 metres.

Background:

We reviewed the 2023 bridge appraisal, also referenced in this document as "inspection reports" (REF: 2023 Municipal Bridge Appraisal - Rehabilitation/Replacement Needs, completed by ELLIS Engineering Inc. in February 2024).

The above noted structure inspection reports formed the basis for the estimation of the expected remaining service life for each structure, as well as the estimated costs for any future replacement and/or rehabilitation needs for each structure.

Expected Remaining Service Life of Existing Structures:

The expected remaining service life (ERSL) was estimated for each existing structure on a case-by-case basis. In general, we have estimated the ERSL based on four criteria (further defined on the following page):

1. The assessed age of the structure.
2. The intended design life.
3. The type of structure.
4. The current condition of the structure as determined by the 2023 structure inspections.

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1. Age of Structure

The age of some structures could be identified from the inspection reports. However, the age of many structures was estimated from the type of construction, condition of exposed concrete or other elements, and the age of similar proximal structures.

The estimated construction dates for bridges, culverts, and pedestrian structures are illustrated in Figure 1, below.

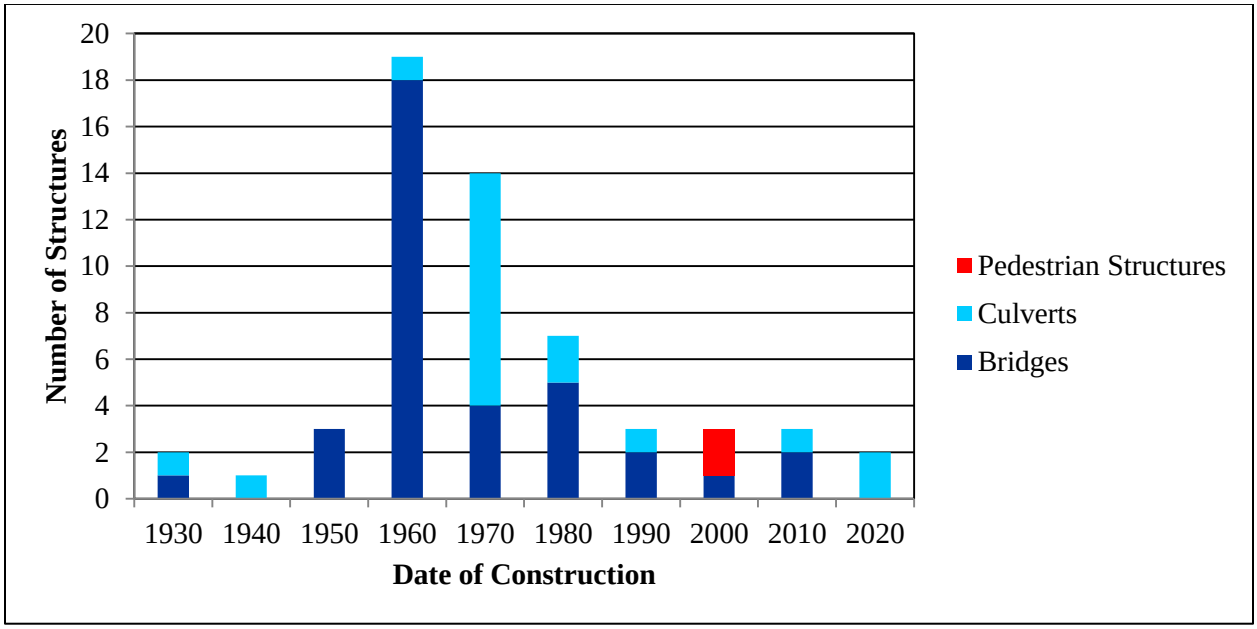

Figure 1: Estimated Dates of Construction

2. Intended Design Life

Previous to the 2000 Canadian Highway Bridge Design Code (CHBDC, CSA-S6-00), the design service life for span bridges was typically 50 years. The 2000 code (and subsequent codes) increased the design service life to 75 years. For structures with estimated dates of construction prior to 2000, an intended design service life of 50 years may be applied. For structures with estimated dates of construction after 2000, an intended design service life of 75 years was applied.

3. Type of Structure

For structure types with high potential for corrosion (such as Corrugated Steel Pipe) an ERSL of less than 50 years was applied. Our experience indicates that the rate of corrosion depends largely on the waterway. A design service of 60 years was applied to the two pedestrian structures in the Town's inventory.

In our experience, we have found certain structure types (such as concrete rigid frames and concrete rigid box culverts) consistently exceed their intended 50 year design life. Depending on the current condition of structure, roadway type, and quality of construction, a concrete rigid frame structure may remain in service for 75-100 years.

4. Current Condition of Structure

The ERSL of any structure is closely related to the current condition of the structure as determined by the most recent structure inspection. For example, a structure in poor condition that has been recommended for replacement with a priority rating of 'NOW' would have 0 years of service life remaining. Table 1, below, summarizes the relationship between priority rating and ERSL.

Table 1: ERSL for Structures Recommended for Replacement

Priority Rating	ERSL
NOW	0
1-5 Years	5
6-10 Years	10

Any structure that has not been recommended for replacement in the next 10 years would have an ERSL of 15 years or greater. With all else equal, a structure with a better 'General Overall Condition' or a higher 'Bridge Condition Index' (BCI) would have a greater ERSL.

Estimated Replacement and Rehabilitation Costs:

Where relevant, the estimated replacement and rehabilitation costs from the 2023 appraisal (inspection reports) were utilized. Those estimates were calculated based on preliminary engineering assumptions. The accuracy of those cost estimates are in an approximated range of plus or minus 20%. The scope of the 2023 inspection report estimates was for work to be completed in the next 10 years.

For rehabilitation and replacement work beyond the next 10 years, the three following assumptions were utilized as necessary to derive the costs estimates:

1. Design Service Life of 75 years was considered for all replacement structures, excluding corrugated steel pipe structures (CSP), and prefabricated pedestrian bridges. A Design Service Life of 50 years was considered for CSP structures and a Design Service Life of 60 years was considered for prefabricated steel pedestrian structures.
2. No changes made to the roadway geometry or deck cross-section (i.e. single lane structures replaced with single lane structures).
3. Similar hydraulic cross-section and type of foundation.

In general, most structure replacements could be estimated from a unit replacement cost based on the deck area. The unit replacement costs used are based on our most recent construction experience with structures similar in size and complexity.

In general, rehabilitation costs were estimated assuming a minor rehabilitation for each structure after 25 years of service (20% of replacement cost) and a major rehabilitation for each structure after 50 years of service (40% of replacement cost). Table 2, on the following page, summarizes the unit replacement and rehabilitation costs that were utilized.

Table 2: Unit Replacement and Rehabilitation Costs for each Structure Type

Structure Type	Replacement Cost ($/m^2 deck area)	Major Rehabilitation Cost ($/m^2 deck area)	Minor Rehabilitation Cost ($/m^2 deck area)
Small Bridge or Culvert (Deck Area < 150m^2)	$9,000	$3,600	$1,800
Large Bridge or Culvert (Deck Area > 150m^2)	$7,500	$3,000	$1,500
Pedestrian Bridge	$6,500	$2,600	$1,300

Estimated replacement and rehabilitation costs include engineering fees. Design and contract administration fees are estimated as 15% of the construction cost.

Financial Analysis:

The unit cost estimates in Table 2, above, were used (and refined, if applicable) to conduct a net present value financial analysis in general accordance with the Ontario Ministry of Transportation's Structural Financial Analysis Manual. An evaluation period of 75 years was employed. A base discount rate of 2.0% was applied to determine the net present value (NPV) for each structure, enabling a total dollar value to be derived in today's dollars (the applied discount rate is further discussed in the next section) for all anticipated rehabilitation and replacement work on each structure over the next 75 years.

Rehabilitation and replacement life cycle costs (treatments) were applied to each structure on a case-by-case basis in order to produce a realistic net present value model.

The first step was to review any recommendations and/or cost estimates contained in the 2023 inspection reports. If no recommendations existed, then treatments and cost estimates were derived from the relevant inspection data and ERSL of each structure. In general, rehabilitation costs were simplified by assuming a minor rehabilitation for each structure after 25 years of service and a major rehabilitation for each structure after 50 years of service.

A net present value was then produced for each structure. A 75-year Design Service Life was used for all replacement structures (required durability for new structures as per the CHBDC).

Summary of Results:

The results of the net present value financial analysis for a base discount rate of 2.0% are summarized in Table 3, below.

Table 3: Results of Financial Analysis at a Discount Rate of 2.0%

Category of Structure	No. of Structures	Total Deck Area (m^2)	Total NPV Cost for 75 Years	Average NPV Cost per Year over 75 Years	Total NPV Costs for First 30 Years	Average NPV Cost per Year for First 30 Years
All Structures with Spans over 3m	57	4044	$30,862,000	$411,000	$20,786,000	$693,000

Note: Costs rounded to nearest $1,000.

Table 3 indicates that in order to maintain the current inventory of 57 structures, a total of $30,862,000 (in today's dollars) must be allocated over the next 75 years. The average total cost (in today's dollars) to be allocated is $411,000 each year. However, a total of $20,786,000 (in today's dollars) must be allocated over the next 30 years as there is a concentration of costs. The average total cost (in today's dollars) to be allocated is $693,000 per year for the first 30 years. The future average total costs per year should be adjusted for inflation.

Figure 2, below, summarizes the NPV cost per year projected for the next 75 years. The costs are concentrated in the first 30 years with approximately 67% of the total costs occurring during this period. The concentration of costs in the first 30 years is related to the concentration of structures constructed from approximately 1960 to 1980 as summarized in Figure 1 (see page 2).

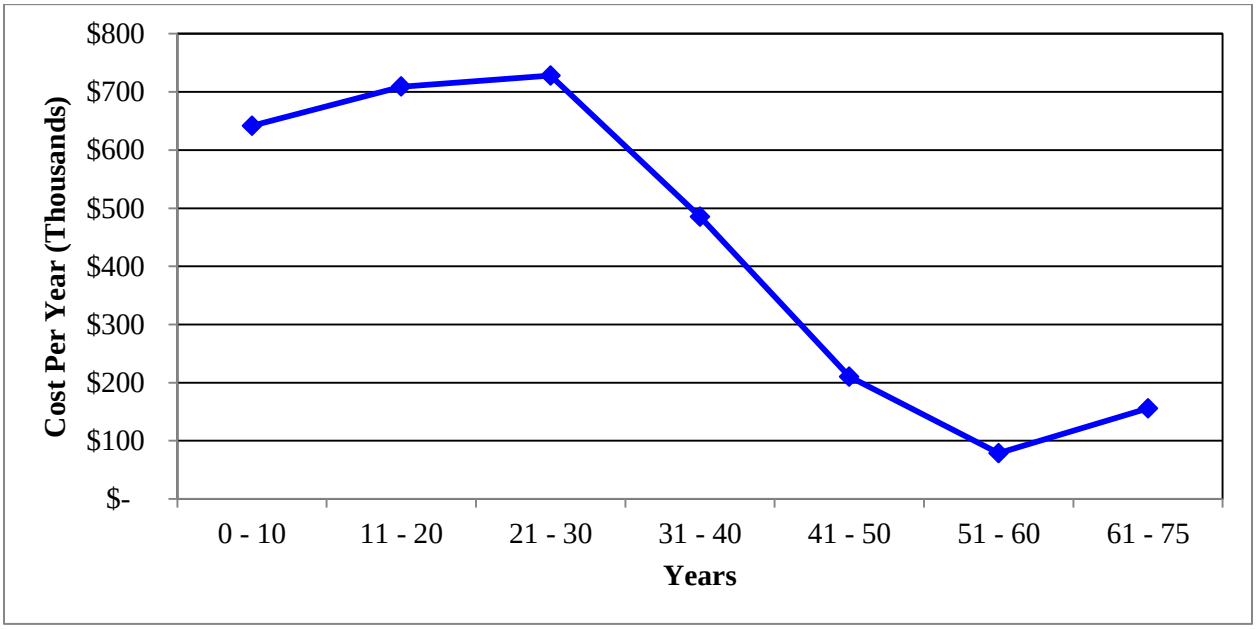

Figure 2: Net Present Value Cost per Year for the next 75 Years

Table 4, below, summarizes the changes in NPV costs from 2019, 2021, and 2023.

Table 4: Comparison of 2019, 2021, and 2023 Financial Analysis Results at a Discount Rate of 2.0%

Category of Structure	2019 NPV Cost per Year	2021 NPV Cost per Year	% Increase 2019 – 2021	2023 NPV Cost per Year	% Increase 2021 – 2023
All Structures with Spans over 3m	$310,000	$333,000	7.4%	$411,000	23.4%

Note: Costs rounded to nearest $1,000.

Table 4 indicates that there has been a 23.4% increase since the 2021 Financial Analysis. This is mostly due to significant increases in the cost of construction over the past two years.

Discount Rate and Financial Sensitivity Analysis:

A base discount rate of 2.0% was used. Variable discount rates were used for the analysis to determine the sensitivity of the cost to the applied discount rate. The total cost and total cost per year were found to be sensitive to the discount rate utilized.

The sensitivity analysis was performed by varying the discount rate +/- 1.5% in 0.5% increments in order to produce a variety of present value financial analysis scenarios. The results of the sensitivity analysis are summarized in Table 5, below.

Table 5: Sensitivity of Results to Discount Rate

Discount Rate	Total NPV Cost for 75 Years	Average NPV Cost per Year over 75 Years
0.5%	$48,023,000	$ 640,000
1.0%	$41,017,000	$ 547,000
1.5%	$35,403,000	$ 472,000
2.0% (Base Rate)	$30,862,000	$ 411,000
2.5%	$27,151,000	$ 362,000
3.0%	$24,092,000	$ 321,000
3.5%	$21,547,000	$ 287,000

Note: Costs rounded to nearest $1,000.

Closing:

We thank you for giving us the opportunity to provide our services for this very interesting project. Should you have any questions concerning the report, please contact the undersigned.

Yours truly,
ELLIS Engineering Inc.

Arih Struger-Kalkman, P. Eng., M. Eng.
Project Manager

Emma Stephenson
Project Assistant

Attachments:

1. *2023 SAMCF - NOTL Spreadsheet (PDF, 1 Page)*
2. *2023 SAMCF - NOTL Spreadsheet (Microsoft EXCEL Spreadsheet, Separate File)*

Town of Niagara-on-the-Lake
2023 Structure Asset Management Cost Forecast

ELLIS Engineering Inc.
March 19, 2024
Job File: 1140

STRUCTURE INFORMATION (More Inspection Data)-->

ID Number	Structure Name	Structure Type	Number of Spans	Span Lengths (m)	Deck Area (m²)	General Overall Condition	Previous BCI	Current BCI	Recommended Work in Next 10 Years	Priority Rating	Total Cost
B11	Line 3 Road	RF	1	5.5	67	Good	75	74	RIR, SPI - Minor Rehab	NOW	$92,500.00
B12	Line 2 Road	RF	1	6.1	82	Good	74	73	RIR, SPI - Minor Rehab	NOW	$98,000.00
B13	Line 1 Road	RCS	1	12.2	172	Good	77	76	RIR	NOW	$8,000.00
B14	Line 1 Road	RF	1	6.3	113	Good	77	76	RIR	NOW	$69,500.00
B15	Line 1 Road	RB	1	4.3	58	Very Good	90	89	None	Adequate	$0.00
B16	Queenston Street	SOSG	3	10.2, 10.2,10.2	264	Good	75	74	None	Adequate	$0.00
B19	Line 5 Road	RF	1	3.8	36	Good	73	72	RIR, SPI - Minor Rehab	NOW	$98,000.00
B20	Line 5 Road	RF	1	3.8	52	Good	74	73	SPI - Minor Rehab	1-5 Years	$29,000.00
B2016	McNab Road	RF	1	4.9	58	Fair	69	68	SPI - Minor Rehab	NOW	$29,000.00
B2020	Townline Road (Grantham Road	SSMP	1	5.5	36	Fair	66	65	None	Adequate	$0.00
B2021	Townline Road (Grantham Road	SSMP	1	4.6	29	Fair	68	66	MIS Work	NOW	$3,000.00
B2022	Townline Road (Grantham Road	SSMP	1	5.5	36	Fair	68	66	None	Adequate	$0.00
B2023	Line 3 Road	RF	1	4.6	40	Good	71	70	RIR, SPI - Minor Rehab	NOW	$103,500.00
B2027	Townline Road (Grantham Road	RF	1	3.7	38	Good	70	70	RIR, SPI - Minor Rehab, MIS Work	NOW	$50,000.00
B2033	Townline Road (Grantham Road	SSMP	1	4.5	30	Fair	64	63	Replace Headwall	1-5 Years	$57,500.00
B2034	Line 8 Road	RF	1	4.9	44	Fair	67	65	SPI - Minor Rehab, MIS Work	NOW	$57,500.00
B2037	Line 8 Road	RF	1	4.4	75	Fair	68	66	RIR, SPI - Minor Rehab, MIS Work	NOW	$63,500.00
B2038	Line 8 Road	RF	1	4.4	75	Good	72	70	RIR, SPI - Minor Rehab	1-5 Years	$103,500.00
B2052	Concession 6 Road	RF	1	3.1	16	Good	73	72	None	Adequate	$0.00
B2060	Warner Road	RF	1	3.1	29	Fair	69	68	None	Adequate	$0.00
B2067	Concession 3 Road	CSP	1	2.8	22	Very Good	45	90	None	Adequate	$0.00
B2085	Line 9 Road	RF	1	3.7	36	Fair	68	67	SPI - Minor Rehab	1-5 Years	$34,500.00
B2091	Line 7 Road	RF	1	5.6	105	Good	75	74	RIR, SPI - Minor Rehab	1-5 Years	$103,500.00
B2093	Line 7 Road	RF	1	4.3	39	Fair	65	64	Replace Structure	6-10 Years	$460,000.00
B2099	Line 6 Road	RF	1	4.3	93	Fair	70	69	SPI - Minor Rehab	1-5 Years	$34,500.00
B21	Line 5 Road	OTHER	1	6.4	31	Poor	50	48	Replace Structure	NOW	$345,000.00
B2101	Line 6 Road	RF	1	5.7	50	Good	71	70	RIR, SPI - Minor Rehab	NOW	$92,000.00
B2102	Line 6 Road	RF	1	4.1	45	Good	72	71	RIR, SPI - Minor Rehab	1-5 Years	$92,000.00
B2106	Line 5 Road	RF	1	4.6	58	Fair	64	63	Replace Structure	6-10 Years	$575,000.00
B2113	Line 4 Road	RF	1	4.9	59	Poor	58	56	Replace Structure	1-5 Years	$575,000.00
B2114	Line 4 Road	RF	1	4.3	35	Good	73	72	RIR	NOW	$69,000.00
B2115	Line 4 Road	RF	1	3.7	36	Good	71	70	RIR, SPI - Minor Rehab	NOW	$92,000.00
B22	Line 5 Road	RF	1	7	83	Good	71	70	Rehabilitation	1-5 Years	$161,000.00
B23	Concession 3 Road	OTHER	1	9.2	30	Poor	15	10	Replace Structure	NOW	$402,500.00
B4	South Shore Lane	SOSG	1	8	30	Fair	64	63	Major Rehabilitation	NOW	$241,500.00
B6	Concession 2 Road	RB	1	4.4	53	Very Good	89	88	None	Adequate	$0.00
B85205	East and West Line	RB	1	3	38	Good	75	74	None	Adequate	$0.00
B85210	Four Mile Creek Bridge	RF	1	15.2	175	Good	77	76	None	Adequate	$0.00
B9	Line 4 Road	RF	1	7	91	Good	72	71	RIR, SPI - Minor Rehab	NOW	$92,000.00
C10	Line 3 Road	SSMP	1	8	136	Good	75	74	None	Adequate	$0.00
C17	Line 2 Road	SSMP	2	3.7, 3.7	120	Poor	58	54	Replace Structure	NOW	$920,000.00
C18	Line 1 Road (Record 1 of 2, 1-5 Years	SSMP	2	3.7, 3.7	141	Poor	60	59	Replace Structure	1-5 Years	$920,000.00
C19	Nassau Road Culvert	RB	1	3.1	60	Very Good	86	85	Mis Work	NOW	$2,000.00
C2006	Church Road	SSMP	1	4.2	114	Good	71	70	RIR	NOW	$69,000.00
C2010	Queenston Road	RF	1	3.7	120	Good	73	72	SPI - Minor Rehab	1-5 Years	$57,500.00
C2011	Queenston Road	RF	1	3.8	130	Good	74	73	None	Adequate	$0.00
C2051	Concession 6 Road	RF	1	3.1	62	Good	75	74	None	Adequate	$0.00
C2053	Concession 6 Road	RB	1	3.5	44	Very Good	90	89	None	Adequate	$0.00
C2054	Concession 6 Road	RF	1	3.7	58	Good	74	73	SPI - Minor Rehab	NOW	$34,500.00
C2117	Line 3 Road	RF	1	3.6	58	Good	76	75	SPI - Minor Rehab	1-5 Years	$34,500.00
C2124	Line 2 Road	RF	1	3	48	Good	72	71	RIR	NOW	$69,000.00
C2129	Line 2 Road	RF	1	3.1	41	Good	70	70	None	Adequate	$0.00
C3	McNab Road	SSMP	2	3.1, 3.1	106	Fair	69	68	RIR, SPI - Minor Rehab	1-5 Years	$80,500.00
C85305	East and West Line	RF	1	3.6	55	Good	73	72	RIR, SPI - Minor Rehab	NOW	$57,500.00
C85310	East and West Line	RF	1	8	146	Fair	68	67	Major Rehabilitation	1-5 Years	$487,000.00
PED1	Creek	PT	1	31	73	Good	74	73	None	Adequate	$0.00
PED2	Creek	PT	1	31	73	Good	72	72	None	Adequate	$0.00

NET PRESENT VALUE ANALYSIS

Discount Rate (DR) = 2 %

Year Constructed	Year of Replacement	Residual Life	Cost to Replace	Year Rehab No.1	Cost Rehab No.1	Year Rehab No.2	Cost Rehab No.2	Year Rehab No.3	Cost Rehab No.3	Year Rehab No.4	Cost Rehab No.4
c.1960	35	35	$ 603,000	0	$ 92,500	15	$ 120,600	60	$ 120,600		$ -
c.1980	40	40	$ 738,000	0	$ 98,000	15	$ 295,200	65	$ 147,600		$ -
c.1960	45	45	$ 1,290,000	20	$ 516,000	70	$ 258,000		$ -		$ -
c.1960	40	40	$ 1,017,000	0	$ 69,500	15	$ 406,800	65	$ 203,400		$ -
2019	70	70	$ 435,000	20	$ 104,400	45	$ 208,800		$ -		$ -
1930	20	20	$ 1,980,000	45	$ 396,000	70	$ 792,000		$ -		$ -
c.1950	30	30	$ 324,000	0	$ 98,000	55	$ 64,800		$ -		$ -
c.1960	30	30	$ 468,000	5	$ 29,000	55	$ 93,600		$ -		$ -
c.1970	25	25	$ 522,000	0	$ 29,000	50	$ 104,400	75	$ 208,800		$ -
c.1970	15	15	$ 324,000	40	$ 64,800	65	$ 129,600		$ -		$ -
c.1970	15	15	$ 261,000	40	$ 52,200	65	$ 104,400		$ -		$ -
c.1970	15	15	$ 324,000	40	$ 64,800	65	$ 129,600		$ -		$ -
c.1960	25	25	$ 360,000	0	$ 103,500	50	$ 72,000	75	$ 144,000		$ -
c.1980	40	40	$ 342,000	0	$ 50,000	15	$ 136,800	65	$ 68,400		$ -
c.1970	15	15	$ 270,000	5	$ 57,500	40	$ 54,000	65	$ 108,000		$ -
c.1960	25	25	$ 396,000	0	$ 57,500	50	$ 79,200	75	$ 158,400		$ -
c.1970	25	25	$ 675,000	0	$ 46,000	50	$ 135,000	75	$ 270,000		$ -
c.1980	30	30	$ 675,000	5	$ 103,500	55	$ 135,000		$ -		$ -
c.1990	40	40	$ 144,000	15	$ 57,600	65	$ 28,800		$ -		$ -
c.1970	25	25	$ 261,000	50	$ 52,200	75	$ 104,400		$ -		$ -
2021	45	45	$ 198,000	20	$ 39,600	70	$ 39,600		$ -		$ -
c.1960	25	25	$ 324,000	5	$ 34,500	50	$ 64,800	75	$ 129,600		$ -
c.1980	40	40	$ 945,000	5	$ 103,500	20	$ 378,000	65	$ 189,000		$ -
c.1960	10	10	$ 460,000	35	$ 92,000	60	$ 184,000		$ -		$ -
c.1960	25	25	$ 837,000	5	$ 34,500	50	$ 167,400	75	$ 334,800		$ -
c.1950	0	0	$ 345,000	25	$ 69,000	50	$ 138,000		$ -		$ -
c.1960	25	25	$ 450,000	0	$ 92,000	50	$ 90,000	75	$ 180,000		$ -
c.1960	25	25	$ 405,000	5	$ 92,000	50	$ 81,000	75	$ 162,000		$ -
c.1960	10	10	$ 575,000	35	$ 115,000	60	$ 230,000		$ -		$ -
c.1960	5	5	$ 575,000	30	$ 115,000	55	$ 230,000		$ -		$ -
c.1960	30	30	$ 315,000	0	$ 69,000	55	$ 63,000		$ -		$ -
c.1960	25	25	$ 324,000	0	$ 92,000	50	$ 64,800	75	$ 129,600		$ -
c.1960	25	25	$ 747,000	5	$ 161,000	50	$ 149,400	75	$ 298,800		$ -
c.1950	0	0	$ 402,500	25	$ 80,500	50	$ 161,000		$ -		$ -
c.1990	30	30	$ 500,000	0	$ 241,500	55	$ 100,000		$ -		$ -
2016	70	70	$ 477,000	20	$ 95,400	45	$ 190,800		$ -		$ -
2006	55	55	$ 342,000	15	$ 68,400	35	$ 136,800		$ -		$ -
c.1960	40	40	$ 1,312,500	15	$ 262,500	65	$ 262,500		$ -		$ -
c.1960	25	25	$ 819,000	0	$ 92,000	50	$ 163,800	75	$ 327,600		$ -
c.1970	25	25	$ 1,224,000	50	$ 244,800	75	$ 489,600		$ -		$ -
c.1970	0	0	$ 920,000	25	$ 184,000	50	$ 368,000		$ -		$ -
c.1970	5	5	$ 920,000	30	$ 184,000	55	$ 368,000		$ -		$ -
2012	65	65	$ 540,000	15	$ 108,000	40	$ 216,000		$ -		$ -
c.1970	20	20	$ 1,026,000	45	$ 205,200	70	$ 410,400		$ -		$ -
c.1970	30	30	$ 1,080,000	5	$ 57,500	55	$ 216,000		$ -		$ -
c.1980	40	40	$ 1,170,000	15	$ 468,000	65	$ 234,000		$ -		$ -
c.1970	40	40	$ 558,000	15	$ 223,200	65	$ 111,600		$ -		$ -
2020	70	70	$ 396,000	20	$ 79,200	45	$ 158,400		$ -		$ -
c.1980	40	40	$ 522,000	0	$ 34,500	15	$ 208,800	65	$ 104,400		$ -
c.1980	40	40	$ 522,000	5	$ 34,500	15	$ 208,800	65	$ 104,400		$ -
c.1930	20	20	$ 432,000	0	$ 69,000	45	$ 86,400	70	$ 172,800		$ -
c.1940	20	20	$ 369,000	45	$ 73,800	70	$ 147,600		$ -		$ -
c.1990	20	20	$ 954,000	5	$ 80,500	45	$ 190,800	70	$ 381,600		$ -
1960	40	40	$ 495,000	0	$ 57,500	15	$ 198,000	65	$ 99,000		$ -
c.1970	35	35	$ 1,314,000	5	$ 487,000	60	$ 262,800		$ -		$ -
2000	25	25	$ 474,500	15	$ 94,900	45	$ 94,900	75	$ 189,800		$ -
2000	25	25	$ 474,500	15	$ 94,900	45	$ 94,900	75	$ 189,800		$ -

NPV CALCS	(DR - 1.5)%	(DR - 1.0)%	(DR - 0.5)%	(DR)%	(DR+0.5)%	(DR+1.0)%	(DR+1.5)%
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Applied Discount Rate (%):	0.5	1	1.5	2	2.5	3	3.5
	$ 800,230	$ 688,429	$ 596,424	$ 520,381	$ 457,267	$ 404,675	$ 360,679
	$ 1,083,177	$ 925,254	$ 797,026	$ 692,316	$ 606,330	$ 535,327	$ 476,375
	$ 1,679,644	$ 1,375,831	$ 1,134,218	$ 940,914	$ 785,344	$ 659,407	$ 556,871
	$ 1,427,122	$ 1,209,496	$ 1,032,792	$ 888,497	$ 770,003	$ 672,158	$ 590,920
	$ 568,119	$ 435,762	$ 337,774	$ 264,669	$ 209,680	$ 167,958	$ 136,015
	$ 2,667,014	$ 2,270,429	$ 1,952,051	$ 1,692,943	$ 1,479,312	$ 1,301,023	$ 1,150,563
	$ 426,228	$ 375,872	$ 333,855	$ 298,676	$ 269,128	$ 244,234	$ 223,203
	$ 502,392	$ 428,963	$ 367,599	$ 316,132	$ 272,817	$ 236,243	$ 205,266
	$ 714,805	$ 598,517	$ 506,712	$ 433,247	$ 373,704	$ 324,872	$ 284,396
	$ 447,441	$ 390,476	$ 344,113	$ 305,860	$ 273,879	$ 246,803	$ 223,610
	$ 360,438	$ 314,550	$ 277,202	$ 246,387	$ 220,625	$ 198,814	$ 180,131
	$ 447,441	$ 390,476	$ 344,113	$ 305,860	$ 273,879	$ 246,803	$ 223,610
	$ 576,469	$ 496,270	$ 432,957	$ 382,291	$ 341,227	$ 307,550	$ 279,635
	$ 506,545	$ 433,361	$ 373,939	$ 325,415	$ 285,568	$ 252,664	$ 225,345
	$ 428,951	$ 380,106	$ 340,136	$ 306,963	$ 279,054	$ 255,269	$ 234,755
	$ 577,765	$ 489,547	$ 419,902	$ 364,170	$ 318,999	$ 281,955	$ 251,249
	$ 932,816	$ 782,444	$ 663,731	$ 568,733	$ 491,737	$ 428,593	$ 376,253
	$ 784,758	$ 677,376	$ 587,440	$ 511,819	$ 447,996	$ 393,935	$ 347,984
	$ 192,230	$ 161,415	$ 136,395	$ 115,964	$ 99,186	$ 85,332	$ 73,829
	$ 342,902	$ 284,758	$ 238,856	$ 202,123	$ 172,352	$ 147,936	$ 127,698
	$ 221,965	$ 178,720	$ 144,687	$ 117,770	$ 96,374	$ 79,286	$ 65,572
	$ 459,322	$ 386,319	$ 328,536	$ 282,160	$ 244,447	$ 213,405	$ 187,570
	$ 1,353,819	$ 1,141,962	$ 969,479	$ 828,281	$ 712,076	$ 615,938	$ 535,995
	$ 651,296	$ 582,659	$ 526,313	$ 479,443	$ 439,938	$ 406,209	$ 377,056
	$ 1,133,302	$ 946,016	$ 798,012	$ 679,437	$ 583,207	$ 504,176	$ 438,562
	$ 513,453	$ 482,713	$ 458,106	$ 438,328	$ 422,368	$ 409,434	$ 398,907
	$ 683,211	$ 582,963	$ 503,821	$ 440,489	$ 389,158	$ 347,062	$ 312,169
	$ 621,824	$ 529,401	$ 456,039	$ 396,967	$ 348,757	$ 308,916	$ 275,613
	$ 814,120	$ 728,324	$ 657,891	$ 599,303	$ 549,922	$ 507,762	$ 471,321
	$ 834,678	$ 765,475	$ 708,736	$ 661,679	$ 622,186	$ 588,635	$ 559,781
	$ 388,110	$ 339,153	$ 298,304	$ 264,102	$ 235,374	$ 211,172	$ 190,725
	$ 517,672	$ 445,493	$ 388,511	$ 342,912	$ 305,954	$ 275,645	$ 250,522
	$ 1,138,445	$ 968,184	$ 833,072	$ 724,314	$ 635,583	$ 562,283	$ 501,038
	$ 599,028	$ 563,166	$ 534,457	$ 511,383	$ 492,763	$ 477,672	$ 465,391
	$ 748,024	$ 670,314	$ 605,474	$ 551,186	$ 505,586	$ 467,170	$ 434,715
	$ 575,215	$ 437,812	$ 336,694	$ 261,730	$ 205,719	$ 163,519	$ 131,444
	$ 438,309	$ 353,342	$ 286,748	$ 234,310	$ 192,817	$ 159,814	$ 133,423
	$ 1,508,515	$ 1,245,129	$ 1,033,225	$ 861,923	$ 722,795	$ 609,278	$ 516,240
	$ 1,168,004	$ 985,552	$ 841,514	$ 726,250	$ 632,828	$ 556,213	$ 492,707
	$ 1,608,093	$ 1,335,418	$ 1,120,152	$ 947,890	$ 808,270	$ 693,769	$ 598,859
	$ 1,369,207	$ 1,287,236	$ 1,221,616	$ 1,168,876	$ 1,126,315	$ 1,091,823	$ 1,063,751
	$ 1,335,485	$ 1,224,761	$ 1,133,977	$ 1,058,687	$ 995,498	$ 941,816	$ 895,650
	$ 667,630	$ 520,919	$ 410,621	$ 327,137	$ 263,494	$ 214,601	$ 176,732
	$ 1,381,998	$ 1,176,495	$ 1,011,517	$ 877,252	$ 766,553	$ 674,167	$ 596,201
	$ 1,150,176	$ 980,948	$ 839,559	$ 721,001	$ 621,248	$ 537,047	$ 465,758
	$ 1,561,866	$ 1,311,499	$ 1,108,212	$ 942,209	$ 805,889	$ 693,324	$ 599,863
	$ 744,890	$ 625,484	$ 528,532	$ 449,361	$ 384,347	$ 330,662	$ 286,089
	$ 477,537	$ 363,467	$ 279,519	$ 217,285	$ 170,786	$ 135,752	$ 109,123
	$ 731,332	$ 619,631	$ 528,933	$ 454,870	$ 394,050	$ 343,829	$ 302,131
	$ 730,483	$ 617,956	$ 526,458	$ 451,618	$ 390,043	$ 339,089	$ 296,679
	$ 650,894	$ 564,366	$ 494,902	$ 438,369	$ 391,759	$ 352,860	$ 320,032
	$ 497,034	$ 423,125	$ 363,791	$ 315,503	$ 275,690	$ 242,463	$ 214,423
	$ 1,363,533	$ 1,170,527	$ 1,015,258	$ 888,602	$ 783,910	$ 696,297	$ 622,141
	$ 718,289	$ 612,365	$ 526,359	$ 456,127	$ 398,453	$ 350,829	$ 311,288
	$ 1,773,366	$ 1,535,593	$ 1,339,966	$ 1,178,224	$ 1,043,849	$ 931,670	$ 837,569
	$ 713,326	$ 602,378	$ 513,632	$ 441,644	$ 382,490	$ 333,310	$ 291,990
	$ 713,326	$ 602,378	$ 513,632	$ 441,644	$ 382,490	$ 333,310	$ 291,990
TOTAL:	$ 48,023,265	$ 41,016,578	$ 35,403,489	$ 30,861,629	$ 27,151,073	$ 24,091,759	$ 21,547,407
Total/75 years:	$ 640,310	$ 546,888	$ 472,047	$ 411,488	$ 362,014	$ 321,223	$ 287,299

Notes:
-Cost to replace B16 (Queenston St) is in line with LCE/RRA Report recommendation to remove and fill ($1,500,000). LCE/RRA report completed in 2012.
-B21 and B23 (field entrances) recommendations are for replacement or removal. Costs included for replacement.
-Unit price not used for B4 (Firelane 11A).
-Prefrabricated steel pedestrian bridge (PED1, PED2) design service life of 60 years.
-Cost for pedestrian bridge replacement (PED1, PED2) is $6500/m².
-Design Service Life of 50 years was used for all corrugated steel pipe (CSP) structures.

Table 1: Unit Costs for Small Structures (Deck Area < 150m2)

Replacement Cost (sq.m):	$ 9,000	(75 Year life for replacement)
Major Rehab Cost (sq.m):	$ 3,600	(Year 50 from construction)
Minor Rehab Cost (sq.m):	$ 1,800	(Year 25 from construction)

Table 2: Unit Costs for Large Structures (Deck Area > 150m2)

Replacement Cost (sq.m):	$ 7,500	(75 Year life for replacement)
Major Rehab Cost (sq.m):	$ 3,000	(Year 50 from construction)
Minor Rehab Cost (sq.m):	$ 1,500	(Year 25 from construction)